THE CONTEXTUALIZED SITUATIONS CONSTRUCTED FOR THE USE OF STATISTICS BY SCHOOL MATHEMATICS TEXTBOOKS

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ABSTRACT

The consideration of context is crucial in the discipline of statistics. In this paper, I present a Foucauldian discourse analysis (FDA) of two popular high school mathematics textbook series in the United States investigating what contextual situations they construct for the (re)use of statistics. As FDA is a novel approach in statistics education, an extended discussion is provided to help show a rationale for its use and to provide a foundation for others. An important finding is that the contextualized situations presented in both textbook series are predominantly fictional, neutral, and provide limited raw data. The findings have implications for the teaching and learning of statistics in view of recent calls for more focus on data and statistical literacy in schools.

Keywords: *Statistics education research; Textbook analysis; Citizenship; Context*

1. INTRODUCTION

Societies today are drenched in data and this trend is only increasing in our current information age. Statistics and data-based arguments are more common in people's everyday lives than they have been in the past. They are used in a number of powerful ways including to guide government policy and business decisions, and to influence public opinion and consumers. To be able to be actively engaged in one's local, state, and national communities, a high level of statistical literacy is crucial today in order to make sense of governmental technical reports and policy decisions (Ullmann, 2016). Statistics and data-based arguments are also common in politician's speeches, meant to influence public opinion, and require heuristics and statistical literacy to make sense of and question (Ridgway, 2016a). Examples of this can been seen in the most recent Brexit vote and U.S. presidential election where there was rampant reporting of the misuse of statistics to sway public opinion (Belham, 2016; Spiegelhalter, 2016). Because our societies are becoming increasingly data-centric, statistical literacy has become a crucial literacy for citizens today (Engel, 2017; Franklin et al., 2007; Utts, 2003; Weiland, 2016).

In the context of schooling in the United States, the development of statistical literacy is supposed to come from the teaching of statistics concepts in middle and high school mathematics classes (Franklin et al., 2007; National Council of Teacher of Mathematics, 2000; National Governors Association Center for Best Practices [NGA Center] & Council of Chief State School Officers [CCSSO], 2010). Unfortunately, most mathematics teachers have had little to no prior experience with statistics (Shaughnessy, 2007). There are recommendations to remedy this issue in teacher education (Franklin et al., 2015). It will, however, take time for the effects of such recommendations to become common in the classroom. So how do teachers with little experience in statistics plan and teach statistics concepts to their students? One very likely resource for teachers to rely on is the textbooks available to them.

A number of scholars have reported on the influence of mathematics textbooks in shaping classroom instruction and students' learning (Fan, Zhu, & Miao, 2013; Tarr et al., 2008; Remillard & Heck, 2014; Stein, Remillard, & Smith, 2007). Though textbooks do not dictate the enacted curriculum of the mathematics classroom, in the case of statistics, where teachers often do not have much prior experience with the subject, textbooks may be highly influential in shaping the enacted curriculum of the classroom. The potential of textbooks to influence teachers' and students' constructions of what statistics is, and how it can be used, makes it important to investigate how statistics is constituted in

Statistics Education Research Journal, 18(2), 18–38, http://iase-web.org/Publications.php?p=SERJ

school mathematics textbooks. In particular, because statistical literacy has become so important for citizenship, and because the consideration of context is central to statistics (Cobb & Moore, 1997; Wild & Pfannkuch, 1999), it is crucial that statistics is being constituted as a discipline that is useful for making sense of societally important contextualized situations such as human migration, health care, racism, sexism, climate change, and water quality (Frankenstein, 2009; Weiland, 2017). To begin to investigate contextualized situations presented in mathematics textbooks I investigated the following research question: *How are the contextualized situations for the use of statistics formed by the statements in the statistics lessons of two major high school mathematics textbook series?*

2. BACKGROUND

In order to provide relevant background for the study I begin by discussing the role of context in the discipline of statistics to both rationalize the focus and to provide a disciplinary perspective. I then discuss past work investigating textbooks in the contexts of mathematics and statistics education before ending with describing the theoretical framing I use for the study, which views textbooks as a form of discourse.

2.1. THE ROLE OF CONTEXT

In statistics, "data are not just numbers they are numbers with a context" (Cobb & Moore, 1997, p. 801). This is a departure from mathematics where numbers are frequently presented and used in their abstract form without any connection to context (Gattuso & Ottaviani, 2011). In mathematics, context is often stripped away from a problem to try and uncover, or abstract, the underlying mathematical structure of the context (Cobb & Moore, 1997): this has been referred to as vertical mathematization (Van Den Heuvel-Panhuizen, 2003). The goal is to move beyond the context to find the generalizable mathematical patterns and structures. On the other hand, in statistics the analysis of data cannot be considered without thinking about the context of the data (Cobb & Moore, 1997; Franklin et al., 2007; Wild & Pfannkuch, 1999). Context determines how and what data to collect, as well as how to analyze the data and interpret the results. This results in a constant interplay between considering a statistical problem and the context of the problem (Groth, 2007; Wild & Pfannkuch, 1999). The goal is not to abstract beyond the context, but to gain a better understanding of the context itself, which means there is a constant interplay between the concrete and abstract in statistical reasoning that differs from mathematical reasoning, which is often done free from context (delMas, 2004).

The differences discussed in the way that mathematics and statistics generally treat context have implications for both research and curriculum design (Groth, 2015). For instructors to teach statistics concepts well, they must know more than just the relevant theory, they must also have a vast supply of relevant contexts to which it is appropriate to apply theory. In contrast, in school mathematics, a knowledge of the theory is generally enough to create problems and examples on the spot (Cobb & Moore, 1997).

The importance of context in statistics makes it particularly powerful for dealing with sociopolitical issues such as race, gender, sexuality, climate change, health care, social class, gun control/rights, human migration, extreme nationalism, and other meaningful real-life contexts (Frankenstein, 2009; Lesser, 2007). Such contexts are at the forefront of influencing and dividing societies today. It is exactly such controversial issues with which students are confronted in their daily lives outside of school, or soon will be. Statistics provides a powerful vehicle to introduce such issues in the school curriculum because as Gattuso and Ottaviani (2011) point out, "statistical concepts linked to context should be approached as social constructs, following the way suggested by the data-oriented approach" (p.124). The teaching of statistics has immense potential to be a gateway to introducing contextual discussions from students' lives into the mathematics classroom (Gattuso, 2006; Scheaffer, 2006; Usiskin, 2014). Related to the focus of this study, as a field, we know very little about what contexts are being presented to students in the classroom for the (re)use of statistics.

2.2 TEXTBOOK RESEARCH

In order to investigate how contextual situations are made available for students to see the (re)use of statistics, I focus on investigating popular mathematics textbooks. Textbooks are important to investigate because of their influence in shaping the enacted curriculum of mathematics classes, mediated by teachers. For example, based on a survey of a nationally representative sample of school science and mathematics teachers in the United States, 81% (SE = 1.0) of the high school mathematics teachers surveyed reported using commercially published textbooks/programs and more than two-thirds reported covering 75–100% of their text (Banilower et al., 2013). These findings point to a real issue, which is "the power of the publishers of textbooks and of the developers of the curriculum to determine the view of the world presented" (Delpit, 2006, p. 24).

Based on an extensive review of the prominent journals in both the fields of mathematics and statistics education, few scholarly works specifically focus on investigating the statistics content of school mathematics texts in the United States. Much of the previous research is focused on analyzing the proportion of middle and elementary school texts that include statistics content and their alignment to the *Guidelines for Assessment and Instruction in Statistics Education* ([GAISE]; Franklin et al., 2007) framework (e.g., Bargagliotti, 2012; Jones et al., 2015; Jones & Jacobbe, 2014; Pickle, 2012; Tran, 2013; Tran & Tarr, 2018). Furthermore, only one study focused on the statistics content of high school mathematics texts (i.e., Tran, 2013; Tran & Tarr, 2018), which is the focus of this study. Though Tran did consider context in relation to its role in the statistical investigative cycle, he did not explicitly investigate in what contexts the tasks were presented.

There are two studies from my review of the literature that consider the context of the tasks being presented in texts. First, Huey and Jackson (2015) constructed an informal inferential reasoning task framework: one dimension of which is context. They considered limited or no reasoning tasks to be those in which a task could still be addressed fully even after removing the context. Tasks where considering the context is helpful for generating an inference, but is not necessary, were considered medium-level reasoning tasks. Finally, they considered high-reasoning tasks as those in which the context must be considered to generate an inference. Though this work is theoretical, it helps to highlight the importance of the consideration of context in statistics tasks.

In a previous study analyzing a high school textbook series in the United States (Weiland, 2006), I found that the tasks only required students to interact with the contexts presented in the texts at a very superficial level, making the actual contexts relatively meaningless to completing the tasks. This finding relates to Huey and Jackson's (2015) framework, particularly their low/no level of informal inferential reasoning. Furthermore, I found the data sets provided were predominantly small ($n < 30$), consisted of one or two variables, and were mostly fictional. The study presented here continues in this direction to expand upon the research around the contexts presented in the statistics lessons of school mathematics textbooks.

2.3 DISCOURSE

To investigate the contextualized situations high school mathematics textbooks provide students for exploring statistical ideas, I take a discursive perspective viewing textbooks as discourse. More specifically, I am drawing from Foucault's perspective of discourse (Foucault, 1971, 1972; Mills, 2003; Walshaw, 2007). Though this perspective is widely used in general educational research, currently it is far less common in mathematics education and relatively non-existent in statistics education work. Over time, and in different contexts, Foucault's use of the term discourse shifted. In this study, I am drawing upon the description of discourse most commonly attributed to him: "as a regulated practice that accounts for a certain number of statements" (Foucault, 1972, p. 80). This perspective of discourse views it as a regulated practice that has underlying rules that are generally taken for granted. As Walshaw (2007) describes, these regularities "specify what is possible to speak, do, and even think, at a particular time" (p. 19). From an epistemological perspective this makes discourse very powerful, producing what is considered knowledge or truth regimes in particular historical, social, and political spaces (Foucault, 1972; Mills, 2003; Popkewitz, 1997; Walshaw, 2007).

Discourses are socially, culturally, and historically situated, and as such, a discourse must be "treated as and when it occurs" (Foucault, 1972, p. 25). In relation to this study, the discourses of the

high school mathematics texts investigated are situated in classrooms and educational social settings and culturally, in a western society, namely the United States. These discourses are historically situated in the early decades of the twenty-first century at a time of significant change in the educational setting in the United States due to the implementation of the Common Core State Standards (NGA Center & CCSSO, 2010). They are also situated at a time of significant political division, rising nationalism, and a devaluing of the sciences and expertise in the United States. It is important to have this contextual framing in mind for this study as the contextualized situations produced by the discourses of the textbooks were analyzed and considered in the social, cultural, and historical spaces described. Furthermore, in considering not only what is produced by these texts, but also considering what is left silent, I consider those silences from my own subjectivity situated in these contexts.

Unfortunately, there has been very little work done investigating mathematics textbooks using a discursive lens drawing from Foucault. An exhaustive review of the literature produced only two examples that explicitly focus on analyzing mathematics textbooks in this way. The first was done by McBride (1989); her goal was to "use the ideas of Foucault to analyze how gender is conceptualized in the teaching of mathematics" (p. 40). Towards her objective, she analyzed a number of mathematics texts finding that men were generally positioned as those who created mathematics with very little mention of women's contributions to mathematics. Furthermore, she found the historical pictures provided in texts were almost always of men, and the cartoons were often of women expressing difficulties understanding the mathematical content. The second is a chapter in a book by Hottinger (2016) where, similar to McBride, she investigates the masculine construction of mathematics in middle school mathematics texts. One critique of both pieces is that they are vague on describing their methods, which is a common critique of Foucault (see Kendall & Wickham, 1999) and I will try to address this critique relative to this study in the methodology section.

3. METHODOLOGY

In this section, I begin by describing the methodology of archaeology to provide some perspective, as archaeology is not a common methodology in the field of statistics education. I then discuss more specifically how I employed that methodology to study the specific question of *how are the contextualized situations for the use of statistics formed by the statements in the statistics lessons of two major high school mathematics textbook series?*

3.1 ARCHAEOLOGY

There are generally two types of methodologies attributed to Foucault; archaeology and genealogy (Arribas-Ayllon & Walkerdine, 2008; Bazzul, 2014; Kendall & Wickham, 1999; Walshaw, 2007). For this study, I drew upon Foucault's notion of archaeology, which is a historical approach to interrogate the "regimes of truth" formed by the rules or regularities of statements in discourse (Bazzul, 2014; Walshaw, 2007). My rationale for using archaeology is that I am interested in investigating what is made possible by the texts, which requires an open inductive approach. I chose to use archaeology instead of another inductive approach, such as grounded theory, because of the ontological and epistemological underpinnings of the methodology that allow particular claims to be made. In particular, the archaeological approach acknowledges the power of texts to create possible realities and truths that is often not acknowledged by other textual analysis methods.

The underlying ontological perspective of archaeology is to reject the existence of knowable, objective, independent reality *that individuals can access* (Arribas-Ayllon & Walkerdine, 2008; Kendall & Wickham, 1999; Popkewitz, 1997; Walshaw, 2007). This stance does not deny the existence of a tangible, objective reality; it merely rejects that it can truly and fully be known by individuals, as reality for people is always filtered through discourse. It is through the rules and regularities in statements, constituted by various discourses, which crystallize or reify such structures that shape and construct the reality we perceive. Epistemologically, knowledge or "truth" is viewed as socially constituted by discourses. Various "regimes of truth" are created through rules and regularities in statements in discourses that are historical and situated in context. It is rooted in this ontological and epistemological stance, that I investigated the research question I posed, focusing on what is formed by discourse of the mathematics texts.

Archaeology differs from other inductive approaches that typically focus on reading into the texts, assigning responsibility to individual authors and their values and beliefs for their production. Instead in an archaeological analysis it is crucial to focus specifically on what the texts state, without attempting to delve beneath the surface of the texts to infer the politics at play or the meaning meant to be transferred. The focus is instead to stay on the surface of the texts, looking at what statements are made of, as well as which are repeated, focusing on what is formed by the discourse (Kendall & Wickham, 1999).

To investigate formations of discourse, which is the focus of this study, the analysis is "centered on a description of the statement in its specificity" (Foucault, 1972, p. 114). The unit of analysis therefore is statements, as statements are the building blocks of discourse just as sentences are the building blocks of texts (Foucault, 1972). Statements in discourse operate in different ways. For example, they can operate as a referential by creating objects or things, or as a subject creating the subjectivities that individuals can take up and position themselves. The function relevant to the focus of this study is materiality. Materiality functions to create the possibilities for the use and re-use of things. The function of materiality I specifically consider are statements that operate to form the contextual situations in which the use and re-use of statistics is made available and positioned as appropriate or normal. In other words, from an epistemological perspective, discursive formations of materiality can construct in what situations the discourse they are a part of can be used. For example, consider the following statement from the Algebra 1 text of the Houghton Mifflin Harcourt series (Kanold, Burger, Dixon, Larson, & Leinwand, 2015): "One hundred students were surveyed about which beverage they chose at lunch. Some of the results are shown in the two-way frequency table below. Complete the table." (p. 280). Statements like this example function to create contextual situations associated with personal preferences as appropriate for the use and re-use of statistics.

There is more to discourse than just statements: there are also rules that function to regulate how statements form and function, similar to grammar in language. These rules are referred to as discursive practices. It is the rules or discursive practices that operate systematically to form and order objects. Foucault (1972) refers to the "things" formed by discursive practices as discursive formations, which he describes in the following statement:

> Whenever one can describe, between a number of statements, such a system of dispersion, whenever, between objects, types of statement, concepts, or thematic choices, one can define a regularity (an order, correlations, positions and functionings, transformations), we will say, for the sake of convenience, that we are dealing with a discursive formation. (p. 38)

It is such regularities that form the materiality of statistics in mathematics texts. For this study, connecting back to the research question, I studied statements that could be classified as material in their function, forming in what contextualized situations the use and re-use of statistics is possible.

3.2 DATA SOURCES

For this study, I analyzed two purposefully selected textbook series based on the results of the National Survey of Science and Mathematics Education, a survey of a nationally representative sample of science and mathematics teachers in schools across the United States with 7,752 teachers participating (Banilower et al., 2013). In looking at the commercial publishers that were used for high school mathematics texts the top three companies making up the market share were Houghton Mifflin Harcourt with 35% (SE = 1.6), Pearson with 30% (SE = 2.0), and McGraw-Hill with 18% (SE = 1.6) with the traditional Algebra 1, Geometry, Algebra 2 sequence. Because Houghton Mifflin Harcourt and Pearson made up the majority of the market share, I chose to investigate the main textbook series from each of these two publishers.

The National Survey of Science and Mathematics Education was conducted in 2012 shortly after the CCSSM (NGA Center & CCSSO, 2010) began to gain traction. The majority of high school mathematics classes in the survey were using texts published during 2006 or earlier. Because 42 states in the United States were using the CCSSM at the time of the study, it is presumable that many schools had or would be adopting texts specifically aligned to those standards. In an attempt to make the study more relevant, I chose to extrapolate from the findings and select textbook series that explicitly conformed to the CCSSM. Both curricula are specifically aligned to the traditional pathway of Algebra 1, Geometry, Algebra 2 in the CCSSM, which is the most common pathway seen in high schools in the

United States. From Houghton Mifflin Harcourt (HMH) I selected a series called Houghton Mifflin Harcourt Algebra 1, Geometry, Algebra 2 curriculum (Kanold et al., 2015). From Pearson, I selected a series referred to as the Pearson Algebra 1, Geometry, Algebra 2 Common Core curriculum (Charles et al., 2015, aimed a grades 8–12). Table 1 shows the breakdown of how much of each text was focused on statistics content.

Table 1. Total number of pages and proportion of each text that is focused on statistics

	HMH		Pearson	
	Total pages	Pages focused on Statistics	Total pages	Pages focused on Statistics
Algebra 1	942	168 (18%)	792	38 (5%)
Geometry	1002	0 (0%)	876	0 (0%)
Algebra 2	896	207 (23%)	964	74 (7%)
Overall	2840	375 (13%)	2632	112 (4%)

3.3 ANALYTICAL METHODS

The focus of this study is on analyzing the statistics lessons of mathematics textbooks. There are no clear-cut boundaries between what is statistics and what is mathematics. For the practical purposes of the analysis for this study, however, such boundaries had to be drawn. I chose to use the GAISE framework (Franklin et al., 2007) to help to draw boundaries between what I considered statistics lessons for this analysis and what was excluded. I included all lessons that discussed topics from statistics including data exploration and descriptive and inferential statistics. I also included the key concepts from probability including understanding probability as a long-run relative frequency, the concept of independence, and how probability can be used in making decisions and drawing conclusions. I further included lessons focused on modeling if the data being modeled included variability. Lessons were identified using documents correlating the textbook with the Standards provided by each textbook publisher, as well as by reviewing the tables of contents of the texts. Any lessons that were later found to not contain situations with variability or discussions of the topics identified in the GAISE framework as important for statistics in K-12 education were removed from the analysis.

To address the research question and investigate the contexts that are formed for the (re)use of statistics, I specifically identified statements that describe contextualized situations to be investigated with statistics in each lesson. For this analysis, statements were considered based on the tasks or natural groupings of tasks as each task generally considered only a single contextualized situation. For example, in Figure 1 all of the visible text and representations were included as they all corresponded to the same contextualized situation, namely the relationship between the altitude of a plane and the temperature outside the plane. In Figure 2, each individually numbered task was considered its own statement as each presented a different situation to consider. It is important to note that statements did not have to be complete sentences to be considered: some tasks only presented representations of data such as tables with variable labels like tasks 7 and 8 in Figure 2.

Making a Scatter Plot and Describing Its Correlation

Temperature The table shows the altitude of an airplane and the temperature outside the plane.

Plane Altitude and Outside Temperature

Altitude (m)	0	500	1000	1500	2000	2500	3000	3500	4000	4500	5000
Temperature (°F)	59.0	59.2	61.3	55.5	41.6	29.8	29.9	18.1	26.2	12.4	0.6

A. Make a scatterplot of the data
Treat the data as ordered pairs. For the altitude of 1500m and the temperature of 55.5°F, plot (1500, 55.5).

B. What type of relationship does the scatter plot show?
The temperature outside the plane tends to decrease as the altitude of the plane increases. So the data have a negative correlation.

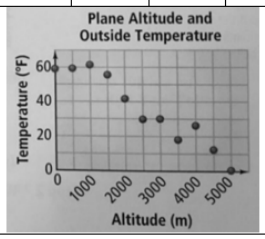

Figure 1. Example of a statement that was analyzed from Pearson Algebra 1 (Charles et al., 2015)

For each table, make a scatter plot of the data. Describe the type of correlation the scatter plot shows.

7.

Jean Sales				
Average Price ($)	21	28	36	40
Number Sold	130	112	82	65

8.

Gasoline Purchases					
Dollars Spent	10	11	9	8	13
Gallons Bought	2.6	3	2.4	2.2	3.5

Theme Parks: Use the table below for exercises 9 and 10.

Attendance and Revenue at U.S. Theme Parks									
Year	1990	1992	1994	1996	1998	2000	2002	2004	2006
Attendance (millions)	253	267	267	290	300	317	324	328	335
Revenue (billions of dollars)	5.6	6.5	7.0	7.9	8.7	9.6	9.9	10.8	11.5

Source: International Association of Amusement Parks and Attractions

9. Make a scatter plot of the data pairs (year, attendance). Draw a trend line and write its equation. Estimate the attendance at U.S. theme parks in 2005.

10. Make a scatter plot of the data (year, revenue). Draw a trend line and write its equation. Estimate the revenue at U.S. theme parks in 2012.

11. **Entertainment:** Use a graphing calculator to find the equation of the line of best fit for the data in the table. Find the value of the correlation coefficient r to three decimal places. Then predict the number of movie tickets sold in the U.S. in 2014.

Movie Tickets Sold in U.S. by Year										
Year	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Tickets Sold (millions)	1289	1311	1340	1339	1406	1421	1470	1415	1472	1470

Source: Motion Picture Association of America

In each situation, tell whether a correlation is likely. If it is, tell whether the correlation reflects a causal relationship. Explain you reasoning.

12. The amount of time you study for a test and the score you receive

13. A person's height and the number of letters in the person's name

14. The shoe size and the salary of a teacher

15. The price of hamburger at a grocery store and the amount of hamburger sold

Figure 2. Example of a page that was analyzed from Pearson Algebra 1 textbook (Charles et al., 2015, p. 341)

The focus of the analysis was not on what was said about each context or the specific statistical actions formed, but on how the types of contexts are made available through regularities in the statements presented in the texts. There are also other elements related to contexts and their quantification to form data that are important in the discipline of statistics that were investigated for regularities as part of investigating how the contextualized situations are formed from the statements. These included the types of variables described in the contextualized situations (quantitative or categorical), what sample size was described (if any), whether raw data, summary statistics, or representations were provided with the contextualized situation, and whether or not real data were provided with the contextualized situation. The analysis of the data was done through an iterative series of three main readings of the data. Each reading and its connection to the archaeological methodology are summarized in Figure 3. The first reading of the texts for the analysis consisted of collecting the data described thus far and organizing it in an Excel spreadsheet. For example, Figure 2 shows a page of text from the Pearson Algebra 1 text (Charles et al., 2015). In this example, there are a number of different contextualized situations presented, some of which consist only of labels on tables that are given, while others are provided in brief descriptions. Each task or grouping of text was then taken as a statement for the Excel spreadsheet that was created during the first reading. Figure 2 shows a page of text that was analyzed, and Table 2 shows the statements selected from the text as well as the other key elements that were collected for each contextualized situation. As a note, there are several issues from a statistical standpoint in the practices formed by the tasks; however evaluating the appropriateness of the statistics actions based on the norms of the discipline was beyond the scope of the analysis presented in this study.

Table 2. Example of analysis protocol for the analysis of statements from the Pearson Algebra 1 text (Charles et al., 2015)

Statement	Context	Variables	*n*[a]	Raw data	Stat[b]	Rep[c]	Real[d]	Var[e]
Jeans sales, average price, numbers sold (Labels from table representation)	Sales	average price, numbers sold	4	Y	N	Table	N	Q
Gasoline, dollars spent, gallons bought (Labels from table representation)	Purchases	dollars spent, gallons bought	5	Y	N	Table	N	Q
A. Make a scatter plot of the data pairs (year, attendance). Draw a trend line and write its equation. Estimate the attendance at U.S. theme parks in 2005. B. Make a scatter plot of the data pairs (year, revenue). Draw a trend line and write its equation. Predict the revenue at U.S. theme parks in 2012.	Business, revenue	year, attendance, revenue	9	Y	N	Table	Y	Q
Use a graphing calculator to find the equation of the line of best fit for the data in the table. Find the value of the correlation coefficient *r* to three decimal places. Then predict the number of movie tickets sold in the U.S. in 2014.	Entertainment, Sales	Year, Tickets sold	10	Y	N	Table	Y	Q
The amount of time you study for a test and the score you receive	Education, school	time studying, test scores	?	N	N	None	N	Q
A person's height and the number of letters in the person's name	personal characteristics	height, name length	?	N	N	None	N	Q
The shoe size and the salary of a teacher	Salary, personal characteristics	shoe size, salary	?	N	N	None	N	Q
The price of hamburger at a grocery store and the amount of hamburger sold	Sales, business	price, hamburgers sold	?	N	N	None	N	Q

[a] Number of data values used in task. [b] Was raw data given. [c] How were the data represented (e.g., Table). [d] Were the data real.
[e] Were the variables Quantitative or Categorical.

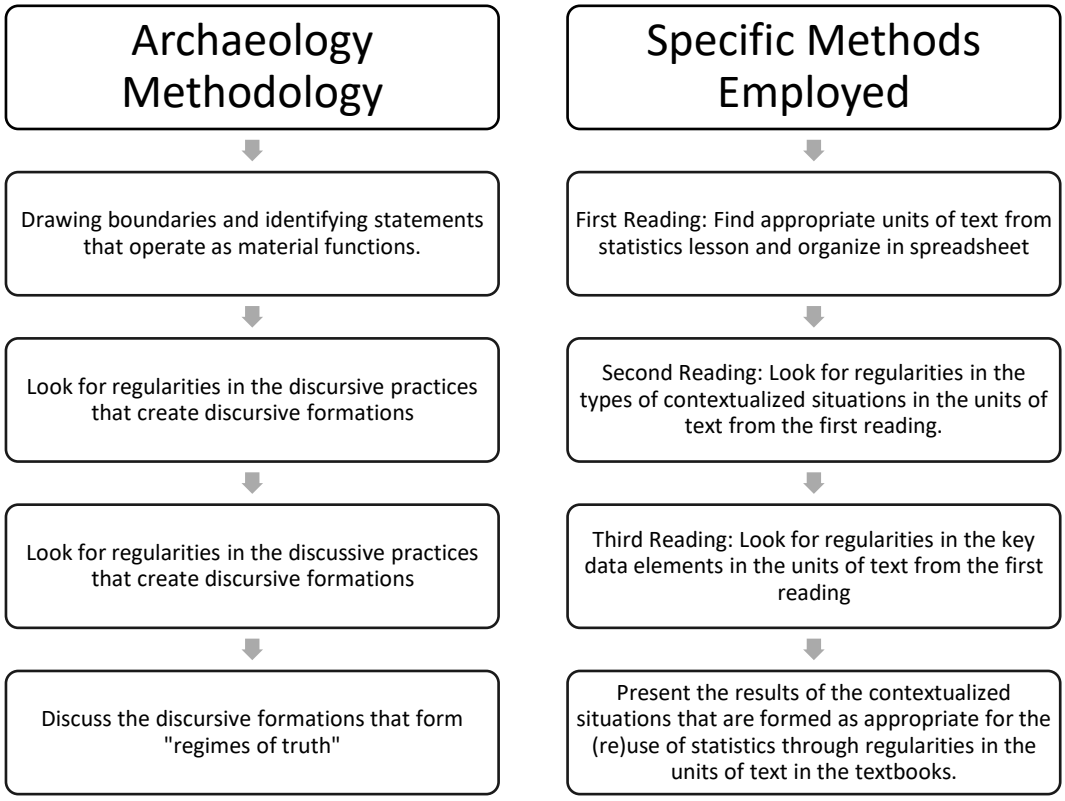

Figure 3. Flowchart outline of the connections between the archaeology methodology and the specific methods employed in this study

The second iteration of the analysis consisted of taking the general contexts recorded for each statement and looking for regularities in the general types of contextualized situations presented in each textbook. Once these general categories were created, I then looked at the variables presented in each category to help describe more specifically the contextualized situations for each category. The descriptions are presented in the findings. The general categories constitute discursive formations of the materiality of the discourse of statistics in the textbooks analyzed. These formations are not objective categories, but categories as they are filtered by my own subjectivity through sustained interactions with the data in an effort to synthesize the formations in the data consistent with the ontological and epistemological underpinnings of the archaeological methodology.

The third iteration of the analysis consisted of looking for regularities in the other elements of each contextualized situation including what sample size was described (if any); whether raw data, summary statistics, or representations were provided with the contextualized situation; and whether or not real data were provided with the contextualized situation. Such regularities are also considered discursive formations of the materiality of the discourse of statistics in the textbooks analyzed. I operationalized real data as data that were provided with a citation of its source. Sample size was operationalized as the number of data observations provided for the analysis requested by the text. For example, in Figure 2, Task 7 would be considered to be a sample size of $n = 4$ as the analysis requested is a correlation of the four sets of ordered pairs provided.

Formations in this reading of the text were synthesized in different ways depending on the element. Sample size was considered as essentially a quantitative variable, simply recording the number of observations considered data points for each statement. Raw data, real data, and summary statistics were each considered as essentially binary variables as either yes it was present or no it was not. Representations were categorized in terms of the specific type of representation used as they all fell into the dominant categories of data displays commonly discussed in statistics.

4. RESULTS

4.1. CONTEXTUALIZED SITUATIONS FORMED

In analyzing the two textbook series, a number of regularities were formed in the types of contextualized situations that are presented for investigation using statistics. The discursive formations of the contextualized situations for the use and re-use of statistics are shown in Table 3. The categories in Table 3 are neither objective nor mutually exclusive, they are merely descriptive of the larger patterns I found in the types of contextualized situations that are formed for the use of statistics by the textbooks. Many statements were associated with multiple formations of contextual formations. For example, the statement shown in Figure 4 discusses exercise, which relates to the entertainment/sports/exercise formation, but it also relates to exercise in terms of its effect on blood pressure, which could be considered part of the health/medical formation or the personal characteristics formation.

Table 3. Discursive formations of contextualized situations appropriate for the use of statistics from the Pearson (Charles et al., 2015) and HMH (Kanold et al., 2015) textbook series

Pearson contextual categories	HMH contextual categories
Entertainment/Sports/Exercise	Entertainment/Sports/Exercise
School/Testing	School/Testing
Science/Weather	Science/Weather
Personal characteristics	Personal characteristics
Voting/Personal preferences	Voting/Personal preferences
Transportation/Travel	Transportation/Travel
Business/Sales	Business/Sales
Manufacturing/Product quality	Manufacturing/Product quality
Food	Food
Pets	Pets
Random draw/Flipping coins/Rolling dice	Random draw/Flipping coins/Rolling dice (Only Algebra 2)
Making decisions/Fair decisions (Only Algebra 2)	Making decisions/Fair decisions (Only Algebra 2)
	Census/Population data
	Work/Salary/Savings
	Health/Medical (Only Algebra 2)

To see whether regular moderate exercise has an effect on blood pressure, researchers have half of the subjects set aside 30 minutes daily for walking and the other half not do any walking beyond their normal daily routines. The subjects also take and record their blood pressure at the same time each day.

Figure 4. Example of statement that could be placed in multiple contextual categories from HMH Algebra 2 textbook (Kanold et al., 2015, p. 868)

There was little variation from Algebra 1 to Algebra 2 texts within both series. The main difference between the Algebra 1 and Algebra 2 texts was the prevalence of contextual situations related to making decisions (including fair decisions or divisions) in the Algebra 2 texts that were not often present in the Algebra 1 texts. In the case of the HMH series there was also the addition of contextualized situation formations related to Random draw/Flipping coins/Rolling dice and Health/Medical situations in the Algebra 2 text that were not present in the Algebra 1 text.

There is a substantial amount of overlap in the contextual situation formations between the two textbook series. The only differences in formations between the series are the prevalence of situations related to the formation of Work/Salary/Savings, Census/Population and Health/Medical that are present in the HMH texts but not in the Pearson texts. Figure 4 is one example of a Health/Medical related statement. Many statements associated with this formation were based around making medical decisions or evaluating medical testing using probability concepts. An example of a statement related to Work/Salary/Savings can be seen in Figure 5.

Several hundred people were surveyed about their salary and the length of their commute to work. The equation of the line of best fit for the data is $y \approx 1.14x + 1.45$ and $r \approx 0.45$. Tell whether each phrase accurately describes the data set.

a. The variables have a strong correlation

b. The variables have a positive correlation.

c. This study shows that there is no correlation between the length of a person's commute and their salary.

Figure 5. Example of a statement related to the work/salary/savings contextual situation discursive formation from HMH Algebra 1 text (Kanold et al., 2015, p. 379)

Typical examples of contextualized situation statements from some of the common formations can be seen in Figure 6. Problems 15, 19, and 20 present typical examples of statements from the voting/personal preference formation. Problem 19 is also an example of a statement related to the transportation/travel formation. Problems 16 and 17 are typical of the types of statements from the manufacturing/product quality formation. Problem 18 is an example of a statement from the science/weather formation. It is, however, atypical because it is the only statement from any of the books that mentions the issue of global warming. A typical example of a statement from the science/weather formation is shown in Figure 1.

Determine whether the sampling method is *random*, *systematic*, or *stratified*. Tell whether the method will produce a good sample.

15. A pollster randomly selects 100 people from each town in a certain candidate's district to see if they support the candidate.

16. A factory tests the quality of every thirteenth shirt made.

17. A printing company randomly selects 10 of 450 books it printed to see if all the books were printed properly.

Determine whether each question is biased. Explain your answer.

18. Since global warming is a big problem, do you support government funding of studies on global warming?

19. Where would you most like to go on vacation?

20. Do you prefer shopping online or the excitement of going to stories with friends?

Figure 6. Example of statements of contextualized situations for the use of statistics from Pearson Algebra 1 (Charles et al., 2015, p. 757)

The examples shown in Figures 1, 2 and 4–6 also show the variation in the length of the statements in the texts. For example, the statements in Figure 2 generally consist of no more than a sentence or two, whereas the statement shown in Figure 1 consists of five sentences, a table, and a graph, all of which are a part of the same contextualized situation.

For practical reasons, I do not present examples from every contextualized situation formation as they generally fit the same structure as the many examples presented thus far. In general, the texts use the different contextual situations rather interchangeably with the types of questions asked, with actions being the foundation, into which different contextual situations are then inserted. The typical variables presented in the statements related to each of the formations are shown in Table 4 to provide more details on the formations.

4.2 KEY ELEMENTS OF CONTEXTUALIZED SITUATIONS

In this section I discuss regularities in the discourse of the textbooks in the key elements of the contextualized situations important in the discipline of statistics related to how data-based information is provided. These include the number and types of variables (quantitative/categorical) described in the contextualized situations; what sample size is described (if any); whether raw data, summary statistics, or representations were provided; and finally whether or not real data were provided. Such elements are important to the discipline of statistics in how contextualized situations are formed, as such information is crucial to making sense of data-based information or arguments.

Table 4. Typical variables formed in each contextual formation

Contextual Formation	Typical Variables	
Entertainment/Sports/Exercise	Sports preference Sports participation Game scores Type of exercise	Event attendance Time spent exercising Race time
School/Testing	Test scores # students in class	Time spent studying # correct answers
Science/Weather	Temperature Time of year Plant Height Geographical location Time Pressure Amount of daylight	Weight of things Altitude Speed Rainfall Animal populations Measurements of animal characteristics
Personal characteristics	Gender Age Grade level Weight	Height Birth date BMI Handedness
Voting/Personal preferences	Color preference Food preference Music preference	Candidate/Policy preference # of votes
Transportation/Travel	Distance traveled Mode of transportation Car value	Time Car characteristics Size of car engine
Business/Sales	Daily, week, monthly, yearly sales Number of employees Product pricing	Product cost Revenue Customer satisfaction
Manufacturing/Product quality	Product manufacturing measurement Product lifespan	Manufacturing cost # defective products # of products produced
Food	Food preferences Crop yields	Fertilizer use
Pets	Type of pets	Number of pets
Random Draw/Flip coins/ Roll dice	#Heads/#Tails Out of rolling die Sum of outcomes of rolling two dice Color of randomly drawn marble	Card drawn from deck of cards Number on spinner Number selected
Fair divisions/Outcomes	Winner selected	Person selected
Health/Medical (HMH Only)	Medicine use Medicine dosage Medical test results	Ailment Cholesterol Blood pressure
Census/Population data (HMH Only)	Population size Time	Life expectancy
Work/Salary/Savings (HMH Only)	Hours worked	Salary

Type and number of variables In terms of the number of variables presented, almost all of the contextualized situations in each textbook provided one or two variables for consideration. In the HMH Algebra 1 textbooks (Kanold et al., 2015), no more than two variables are ever presented in a contextualized situation. In the HMH Algebra 2 text, however, there are seven contextualized situations presented with three variables. In the Pearson Algebra 1 text (Charles et al., 2015), there are five situations with three variables and one situation with four variables. In the Pearson Algebra 2 text, however, there are no contextual situations with more than two variables.

Categorical and quantitative variables were frequently present in all the textbooks (see Table 5). All the texts except for the Pearson Algebra 2 text (Charles et al., 2015) also contained contextual situations that presented both categorical and quantitative variables with regularity. In a few cases it was not possible to determine the type of variables (see Table 5). There was also a pattern in the Algebra 1 texts in both series presenting quantitative variables more often than categorical, with that trend switching in the Algebra 2 texts.

Table 5. Row percentages and total counts of the types of variables present in the contextualized situations in each textbook.

	Types of Variables				
Textbook	Categorical	Quantitative	Both	Unknown	Totals
HMH Algebra I	22.7	67.7	8.4	1.2	251
HMH Algebra II	61.0	32.2	5.8	1.0	382
Pearson Algebra I	35.0	60.3	4.7	0	214
Pearson Algebra II	56.9	40.1	1.0	2.0	202

Sample sizes In looking at the sample sizes of the data-based information presented in the textbook series the statements that presented raw data had smaller sample sizes on average than those that did not present the raw data (see Table 6). The vast majority of the contextual situations that presented raw data consisted of relatively small sample sizes less than 20 observations. As a reminder, sample size in this study was operationalized as the number of data observations provided for the required analysis and are presented here to show the wide variability in sample sizes for each contextualized situation, and to also show thatthe vast majority of the samples presented were small in size.

Table 6. Descriptive statistics for sample sizes for each text disaggregated by whether or not raw data were presented with each contextual situation.

Raw	HMH A1		HMH A2		Pearson A1		Pearson A2	
data?	No	Yes	No	Yes	No	Yes	No	Yes
Min	9	3	3	3	10	3	4	3
Q1	40	7	40	10	58	7	21.5	5.5
Med	80	9	100	12	159.5	10	45	8
Q3	100	13	495	40	843	15	515	12
Max	753	100	12438600	260	5314	73	216100000	36
N	66	133	63	99	20	93	24	56
Mean	97.6	12.6	1600210	40.6	650.9	13	9732400	10.1
SD	103.1	12.3	1567120	56.4	1213	10.9	44100300	7.8

Forms of data-based information Data-based information for each task was presented in a wide variety of forms. Some statements included no data-based information (for example see Figure 4). Other statements included different representations such as histograms, tables, or scatterplots, which were frequently present in all four textbooks.

Table 7 shows the different representations that were formed as appropriate for the presentation of data-based information in contextual situations for each textbook analyzed. Some statements provided data-based information in the form of descriptive statistics for a contextual situation. For example, the statement in Figure 5 presents the correlation coefficient for a linear regression model.

Row percentages and total counts for the number of contextual situations that presented descriptive statistics for each textbook can be seen in Table 8. The Algebra 2 books from both curricula contained a larger proportion of descriptive statistics than the Algebra 1 books.

Table 7. Types of representations formed through regularities in the texts for communicating data-based information in contextualized situations in each textbook

HMH Algebra I	HMH Algebra II	Pearson Algebra I	Pearson Algebra II
Table	Table	Table	Table
Scatterplots	Scatterplots	Scatterplot	Scatterplot
Histogram	Histogram	Histogram	Histogram
Two-way Table	Two-way Table		Two-way table
Dot plot	Dot plot		
Box plot			
			Tree diagram
			Normal curve

Table 8. Row percent and total counts of contextualized situations that provide and do not provide descriptive statistics in each textbook

	Descriptive statistics provided		
Textbook	No	Yes	Totals
HMH Algebra I	62.9	37.1	251
HMH Algebra II	57.9	42.1	382
Pearson Algebra I	87.4	12.6	214
Pearson Algebra II	70.3	29.7	202

A number of statements presented data-based information in the form of raw data. For example, the statement in Figure 1 presents raw data in a table for the contextual situation. Row percentages and counts on the number of contextual situations that present raw data for data-based information can be seen in Table 9. The Algebra 1 texts from both curricula contained a larger proportion of situations with raw data than the Algebra 2 texts did.

Table 9. Row percent and total counts of contextualized situations that provide and do not provide raw data in each textbook

	Raw data provided		
Textbook	No	Yes	Totals
HMH Algebra I	47.2	52.8	251
HMH Algebra II	74.1	25.9	382
Pearson Algebra I	56.1	43.9	214
Pearson Algebra II	72.3	27.7	202

Contextual situations also included data-based information in every combination of representations, descriptive statistics, and raw data. For example, the statement in Figure 1 presented data-based information in the form of both raw data and a representation. When comparing the presence of raw data or statistics in the contextualized situations, only 6% had both with the rest having just one or none.

"Real" data No statements from the Houghton Mifflin Harcourt textbooks (Kanold et al., 2015) contained real data, although they did contain data that might be real, such as Census data. None of the data sets, however, are cited in any way so as to be found by the reader. The Pearson textbooks (Charles et al., 2015) did present some statements with real data: nine statements contained cited data in the Pearson Algebra 1 text and 17 statements contained cited data in the Algebra 2 text. As a note, the statements in the Pearson text that were classified as containing real data barely met the standard set of citing the source of the data using very general descriptions, such as the organization or agency that collected the data (see Figure 7).

Conditional Probability in Statistics

Multiple Choice Americans recycle increasing amounts through municipal waste collection. The table shows the collection data for 2007. What is the probability that a sample of recycled waste is paper?

A) 16% C) 33%
B) 28% D) 57%

The given condition is that the waste is *recycled.* A favorable outcome is that the recycled waste is paper.

Municipal Waste Collected (millions of tons)

Material	Recycled	Not Recycled
Paper	45.2	37.8
Metal	7.2	13.6
Glass	3.2	10.4
Plastic	2.1	28.6
Other	21.7	46.3

Source: U.S. Environmental Protection Agency

Figure 7. Example of a statement that has real data from the Pearson Algebra 2 text (Charles et al., 2015, p. 697)

5. DISCUSSION

Discourses are powerful and form what constitutes knowledge situated in social, historical, and spatial contexts (Foucault, 1971, 1972; Gutiérrez, 2013; Hottinger, 2016; McBride, 1989; Mills, 2003; Walshaw, 2007). The "regimes of truth" constructed by discourse are important for us to consider in terms of what counts as knowledge in statistics education and more specifically in the context of this study what the discourse of textbooks form as knowledge or truth in relation to the contextual situations in which statistics can be used. The discursive formations presented in the results section represent a non-evaluative presentation of what is formed by the texts, consistent with Foucault's archaeological methodology. The formations in the text presented can be interpreted by the reader through their own subjectivity, consistent with the epistemological and ontological perspectives presented earlier. It is also important, however, to consider the findings of this analysis with respect to what is left silent in these texts, in other words, what is not formed. The discourse of these texts does not live in isolation, nor does it represent objective reality; it has cracks and discontinuities that need to be considered, otherwise I am only reifying the "regimes of truth" created by these discourses and not interrogating them. At this point, to interrogate the discursive formations presented in the results I will draw from other discourses, in particular those from statistics education and socio-politically oriented mathematics educators.

It is promising that so many different formations of contextualized situations were present in the textbooks, as it has been pointed out in the past that statistics is often taught abstractly and focused on decontextualized calculations in mathematics classes (Cockcroft, 1982; Gattuso & Ottaviani, 2011). The promise ends there, however, as the contexts that the discourses of the textbooks construct for the use of statistics generally go no further than those typical of "small talk," such as the weather, sports, personal preferences, or related to work or business. There is generally an absence of any kind of situation that might be considered controversial or divisive, which are exactly the types of issues that dominate the media and the broader discourses in our societies today. It is the controversial and divisive sociopolitical issues with which it is important for students to have experiences if they are to be prepared to be critical citizens in today's societies (Frankenstein, 2009; Gutstein, 2006; Weiland, 2017). This absence is notable because one of the main rally cries for statistics education and statistical literacy is to prepare students for citizenship (Engel, 2017; Franklin et al., 2007; Gal, 2002; Wallman, 1993). It is from the goal of preparing students for citizenship that I will continue to interrogate the discursive formations discussed in the results in an effort to (re)imagine what they might be in looking towards the future and the implications the results of this study have for the field of statistics education.

Every contextual situation formation created through this study has the potential for presenting contextualized situations that are sociopolitical. The textbooks instead present contextualized situations in these formations that are very neutral. For practical reasons, I will not delve into every contextual formation. Instead I focus on three major ones—science/weather, voting/personal preferences, and personal characteristics—to provide evidence of how the contextualized situations formed for the doing of statistics in the two textbook series analyzed fell short of constructing statistics as useful for investigating important societal issues that citizens are commonly facing from the perspective I take on the discipline of statistics. The discussion in the paragraphs that follow is coming from my own subject

position on what should be taught as statistics to prepare students to be critical citizens in society (Weiland, 2017).

There is potential in the science/weather formation to discuss one of the more controversial issues in science and society today, the notion of global warming and climate change. Yet, most of the situations in this formation are very neutral, focused on patterns in temperatures at different times of the year or in different locations. Only once is the issue of global warming mentioned in any of the textbooks, and it is associated with identifying biased questions, shown here from the Pearson Algebra 1 textbook (Charles et al., 2015): "Determine whether each question is biased. Explain your answer. 'Since global warming is a big problem, do you support government funding of studies on global warming?'" (p. 757). There is no consideration of variations in temperature over large units of time, the difference between weather and climate, or discussion of how such climate changes are related to human activity. These are all issues that include significant amounts of data modeling, which could be considered in mathematics classrooms in conjunction with developing powerful mathematical and statistical concepts and practices. Other science-related issues that are completely absent from the texts, yet are prevalent in society today include water quality issues like those faced by the residents of Flint Michigan, fracking and drilling for oil including the issues debated in many states over regulating or even allowing such practices related to their effects on the environment, vaccines and their association (or lack thereof) with birth defects and autism, or endangered species and animal populations and their association to changes in their environment and human factors.

Another contextual formation with potential for presenting important sociopolitical issues is that of voting and personal preferences. This is clearly a political formation in the sense that it is specifically about situations in which people are making choices, whether for candidates to represent them, or for what values or positions on issues they prefer. The situations present in the texts, however, are quite withdrawn from the societal aspects of these situations. For example, color preference, which was commonly one of the personal characteristics considered, may be a very meaningful issue to consider for younger students, but high school students are the target audience for these texts. Most high school students face far more serious and complex issues in their lives. I would argue that color preference is no longer as meaningful to students who are at this period in their lives. This is not to say that personal preferences are not meaningful contexts for students to discuss. Personal preferences issues around identity formation or views on the world are likely far more meaningful for students of this age. Furthermore, the textbooks only put forth the personal preferences of others in the contextual situations presented. In other words, the texts are not asking students to think about their own personal preferences, but instead those in fictitious situations presented in the texts. Such discussion does not prepare students to be critical citizens in society.

One of the privileges for people in many western countries that comes with adulthood is the ability to vote and choose those who will represent them in government. All of the texts include contextualized situations associated with voting. They are, however, as neutral as possible and as disconnected from actual issues being voted on in society. For example, consider the following contextualized situation from the Pearson Algebra 2 textbook (Charles et al., 2015):

> Suppose you want to know what percent of all voters in your city favor a tax increase to pay for school improvements. It likely would be impossible to ask an opinion of every voter. So instead you select a sample of the voters to estimate the percentage who favor the idea. (p. 725)

Tax increases and education are both key issues discussed in the sociopolitical space of the United States, yet this situation does not have students consider those issues. Instead, the focus is on how to collect a representative sample for such a vote. Some situations are made to be even more neutral, removing any real-world connections to the choices being voted for such as not giving candidates names, simply referring to them as candidate A and candidate B.

There is a wealth of publicly available voting data from actual elections that could be considered. For example, there have now been two presidential elections in the United States in this century where the winner of the Electoral College lost the popular vote. There is a large amount of mathematics that could be considered investigating such issues. More specific to the focus of this study there are a significant number of statistical considerations such as, what happens when the voting data of elections are disaggregated by age group, sex, or location? In the Pearson Algebra 1 (Charles et al., 2015) textbook an example moving in this direction is the following:

> Error Analysis: Malik is conducting a survey about the legal voting age in the United States. His question is, "Isn't the legal voting age too high?" When his friends suggested that his question was biased, he revised it to be, "Don't you think the legal voting age should be lower?" Describe and correct the error in his rewritten survey question. (p. 758)

Still the focus is not on the context, but on the biased nature of the collection of data. Students could delve into this question by rewriting the survey question such that it is not overtly biased and then using it to survey students in their own school to delve deeper into the issue itself. The textbook did not create such a context as appropriate for the doing of statistics.

Personal characteristics is also a contextual formation that holds great promise, but again falls short on engaging students in making sense of sociopolitical issues in the textbooks reviewed. Most characteristics considered such as height, age, handedness, birth year, or weight are considered in isolation with no connection to broader discussions, such as the rise in childhood obesity or changes in voting or personal preference related to age. Gender, which was the focus of McBride's (1989) investigation of math texts using a Foucauldian discourse analysis, was often present as a variable in this category and is furthermore at the forefront of many larger discourses in society today. However, it was always constituted as a binary (male/female) in both textbook series analyzed, without any possibility for divergence. What is missing is any discussion of how gender is being operationalized as a variable, whether as a biological variable based on chromosomal features (sex) or as a social variable in terms of the gender identification (gender). Such distinction is not made in the texts and the term sex is never used in the Pearson texts (Charles et al., 2015) and is only used once in each of the HMH texts (Kanold et al., 2015).

Even more disturbing is the notable absence of any discussion of issues such as race, or ethnicity, which are front and center in the national discourse in the United States today and arguably have been since the birth of the nation. Such constructs would normally be considered in relation to personal characteristics. However, neither race nor ethnicity is ever mentioned in any of the texts. This seems like a significant omission, as they are very common variables that are collected and considered in almost any data set where people are considered the cases of the dataset. The findings related to the contextual formations are a serious problem if the goal of every high school graduate being statistically literate is to be realized, as these texts do not form the (re)use of statistics in any of the sociopolitical issues that citizens are confronted with in the media and their daily lives.

There are also some serious concerns when considering the findings related to how the data-based information about each situation was presented. To begin, the biggest issue that becomes apparent from the findings of these elements is that for the most part the texts do not present real data to students. Without real data, it is nearly impossible to perceive statistics as a discipline or lens through which to see the world, which is crucial for preparing student to be active citizens in democratic societies (Engel, 2017; Gould, 2017; Weiland, 2017). Instead, students are predominantly presented with fictitious contextual situations that could be real, and they are asked to suppose they are real.

Another issue is that even when data are presented to students in a contextual situation, the number of observations is generally quite small by statistical standards (Field, 2013). This is evidenced by the fact that the median sample size for contextual situations that present data for each text are no more than 12 with the vast majority falling below 40 (see Table 6 for detailed descriptive statistics). Situations with large sample sizes are present, but often only when the data-based information is presented in a synthesized format as a graph or descriptive statistics. In other words, the texts do not create opportunities for students to deal with the messiness of data, which is very prevalent practice in the discipline, especially when dealing with large-scale social issues where there are often many variables and hundreds or thousands of observations. Furthermore, there are increasing calls from the field to engage students in larger datasets (Engel, 2017; Gould, 2010; Prodromou & Dunne, 2017; Ridgway, 2016b).

It is promising that a large number of the contextual situations do present descriptive statistics, as that is the format with which students would most likely be presented in the reading context along with graphical representations. Related to graphical representations, however, there are some notable absences in the types of graphical representations the texts form as appropriate for presenting data-based arguments: for example, the absence of boxplots, which were only present in three of the four texts (only HMH Algebra 1 contained them with any regularity). Boxplots are a common graphical

representation used in exploratory data analysis (Tukey, 1977), which is the basis of much of the K-12 statistics curriculum in the United States.

In conclusion, the discourse of the textbooks analyzed do not construct statistics as useful for people to meaningfully engage in making sense of the common societal issues in the world around them. In other words, related to the question of study, the discourse of the texts analyzed form the (re)use of statistics in predominantly fictional and trivial context and in a manner that is not consistent with the practice of statistics today. This is a serious issue for being a citizen in today's data drenched societies. If students are to be statistically literate, they need to have opportunities to engage in making sense of issues that are in the forefront in their societies and to see how statistics can be a powerful lens for evaluating issues and making informed decisions. In the case of statistics, it is important that curriculum materials are created to provide a resource for the many teachers that have little prior experience in statistics to draw from when teaching their students so that students can have experiences to see and make sense of the world through statistics. Furthermore, beyond curriculum materials, support needs to be provided through teacher education avenues to prepare pre-service and in-service mathematics teachers with the background they need in the content and practices of statistics as well as how to teach in a way that fosters a critical statistical literacy in students. There also need to be changes made at the policy level to support such teaching of statistics, making it the norm rather than the exception. Policy-level changes are also necessary to drive textbook publishers to take the time and expense to create materials that go beyond presenting trivial and fictional contextualized situations for students to do statistics. In other words, there is a need for systematic change on every level and including all stakeholders.

If students are to be prepared to be active engaged citizens in today's data-centric societies, the field of statistics education needs to take some serious steps to consider how to create curriculum materials to foster such statistical literacy at the school level. Though serious attempts have been and are being made at the post-secondary level (e.g., Bergen, 2016; Engel, Schiller, Frischemeier, & Biehler, 2016; Frankenstein, 1998; Lesser, 2007; Schiller & Engel, 2016), at this level the field is only reaching a narrow subset of most populations versus targeting school education, which in most countries is provided freely and/or mandated until age 16 or later. If we want a statistically literate citizenry, we need to construct curricula at the school level that allow students to investigate important societal issues to construct statistics as a discipline that is powerful for making sense of the world. Furthermore, as a field it is important to begin to use more sociopolitical theories such as those from Foucault that foreground the power of discourses in shaping what is considered knowledge or truth. Such frameworks and perspectives will be crucial in helping to make sense of the post-truth era we are finding ourselves in and considering what that means for statistics education.

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